



# Internal Duct Characterization System



**An advanced robotic system for characterizing internal surfaces of ductwork.**



This project was funded by the DOE Office of Science and Technology Development, Robotics Technology Development Program.

## Participants

Idaho National Engineering and Environmental Laboratory  
Inuktun Services, Ltd.  
Automation Systems Associates, Ltd.

## Technology Need

A highly capable inspection system was needed to examine the inside of ventilation ductwork and large pipe. The ventilation ductwork systems of contaminated nuclear facilities are likely to contain materials of concern and require proper characterization in order to complete U.S. Department of Energy (DOE) remediation efforts. Numerous remotely operated visual inspection systems are available, but they have limitations in several key areas including maneuverability, adaptability, and the incorporation of characterization sensors. A remote characterization vehicle that is adept at inspection tasks within ventilation duct systems was determined to be a

technology need within DOE, and potentially within industry with the increasing concerns about "sick building syndrome."

## Research Objective

The objective of the Internal Duct Characterization System (IDCS) project was to develop a state-of-the-art robotics system for characterizing the inside of ductwork with design and development participation by industry.



## Technology Description

The D&D Robotics Program specified, procured, tested, and demonstrated the IDCS in 1995. The IDCS was designed and fabricated by a team of two commercial manufacturers of remote inspection and automation equipment: Inuktun Services and Automation Systems Associates.

The IDCS is a remotely operated vehicle system that has the capability to maneuver through ductwork systems as small as 6 inches in diameter, travel up to 250 feet through multiple fittings or branches in ducts ranging from 6 to 36 inches in diameter, and visually inspect the interior condition of ducts using innovative color video camera technology. In addition, the vehicle has an integrated radiation sensor to characterize the radiological contamination inside the ductwork and the directional sensors necessary to produce as-built mapping of the ductwork.

The IDCS has a limited capability to take samples, and to clean or

decontaminate small areas. Most of these capabilities have been individually achieved with existing systems, but the IDCS was the first remote inspection system to integrate them.

## Technology Status

All of the original technical workscope was completed on the IDCS in 1995. The IDCS was subsequently used to inspect over 200 feet of a mildly contaminated off-gas duct at the Idaho Chemical Processing Plant (ICPP) in January 1996.

A vertical travel carriage for 8 inch to 12 inch pipe was also developed in 1996 based on the drive units made for the IDCS.

The IDCS, the vertical travel carriage, and smaller, less complex systems based on IDCS technology are currently available commercially through the lead industrial partner, Inuktun Services, Ltd.

## Research Opportunities

Many research opportunities for this technology are waiting to be explored. For instance, other characterization sensors could be incorporated onto the IDCS. Candidate sensors would include polychlorinated-biphenyl (PCB) detectors, chemical detectors, and eddy current and ultrasonic sensors. In addition, miniature manipulators, laser ablation heads, and decontamination tools could be integrated into the system.

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